

EXTRACTION OF LEAD (II) WITH TRIPHENYL ARSINE OXIDE

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Abstract

A sensitive and rapid method has been proposed for the extraction and determination of microgram amounts of lead as salicylate using triphenyl arsine oxide as an extractant. The lead salicylate complex is quantitatively extracted by 0.05% (w/v) triphenyl arsine oxide from $5 \times 10^{-2} \text{M}$ to $1.5 \times 10^{-1} \text{M}$ sodium salicylate in a total volume of 25 ml. The pH was adjusted between 3.3 and 5.0 with ammonia solution. The solution was transferred to a separating funnel and equilibrated for 40 sec. After phase separation, the aqueous phase was discarded and lead from organic phase was stripped with water. The stripped lead was finally estimated spectrophotometrically with PAR at 520 nm^3 . The log-log plot has been used to ascertain probable extractable species. The method has been applied for the analysis of alloy and environmental samples.

Lead is widely used in plumbing, paint, and gasoline. However, due to its toxicity, many of these uses have been phased out. It is still used in lead-acid batteries, which are common in cars and backup power systems. Lead is also used for shielding in radiation protection, such as in medical imaging or nuclear reactors.

The hazardous effects of toxic metals present in the environment on human health have attracted much attention recently. Chronic exposure to lead causes nephritis, scarring and shrinking of kidney tissues, while short but intense exposure causes functional injury.

Experimental

A spectrophotometer and a digital pH were used for the absorbance and pH measurements respectively.

A stock solution of lead was prepared by dissolving 2g of lead nitrate in 250 cm^3 distilled water containing 0.5 cm^3 conc nitric acid. The solution was standardised complexometrically⁵ and further dilutions were made as required.

An aqueous solution (0.1%) of 4-(2-pyridylazo) resorcinol (PAR) was used for the spectrophotometric determination of lead. Triphenyl arsine oxide in chloroform was used as extractant for lead. All other chemicals used are AR grade.

Results and Discussion

Variations in pH (2.0-8.0), Triphenyl arsine oxide concentration (0.005-1.5% w/v with chloroform as the solvent) and salicylate concentration 2.5×10^{-4} - $1 \times 10^{-2} \text{M}$ showed that the quantitative extraction of lead (40Ug) was feasible with 0.05% (w/v) triphenyl arsine oxide in chloroform from $5 \times 10^{-3} \text{M}$ to $1.7 \times 10^{-1} \text{M}$ sodium salicylate in a total volume of 25 ml. The pH was adjusted between 3.3 and 6.0 with ammonia solution. The solution was transferred to a separating funnel and equilibrated from 5 sec to 60 sec. It was seen that quantitative extraction of lead occurs in 40 sec.

The nature of the extracted species was established using log-log plot. A plot of log of distribution ratio D versus log of Triphenyl arsine oxide concentration at fixed salicylate concentration and fixed pH gave a slope of 1.8 indicating a molar ratio of 1:2 with respect to the extractant. Triphenyl arsine oxide causes the lead salicylate complex and thus promote the extraction. The probable extracted species is $\text{Pb}(\text{HOC}_6\text{H}_4\text{COO})_2 \cdot 2\text{TPAsO}$.

Effect of solvents

Extraction was done with different solvents such as toluene, benzene, chloroform and carbon tetrachloride, xylene. The extraction was quantitative with chloroform as the diluent.

Effect of Foreign ions

Varying amounts of diverse ions were tested for their effect on extraction and determination of lead (40 μ g) by Ni(II) (100 μ g), Cu(II) (80 μ g), Ca(II)(3000 μ g), Sn(II)(150 μ g), Cd(II)(200 μ g), Co(II)(50 μ g), As(III)(150 μ g), Mg(II)(3000 μ g), Fe(III)(200 μ g), Bi(III)(50 μ g), Zr(IV)(50 μ g), Sb(III)(400 μ g), Ce(IV)(40 μ g), Cr(VI)(100 μ g), Zn(II)(500 μ g) tartarate (400 μ g), citrate(500 μ g), oxalate(1000 μ g), nitrate(2000 μ g) were tolerated.

Analysis of alloys and Synthetic samples.

Alloys of lead such as leaded bronze, leaded gun metal have been analysed by the proposed method .100 mg of the alloy was dissolved in 3 cm³ of nitric acid and the solution was evaporated. Water was added to the residue and the precipitated metastannic acid was filtered. The precipitate was washed first with hot dil nitric acid and then with hot water. The filtrate was diluted to 25 cm³. Aliquot of each sample was taken and lead in the sample determined by the proposed method.

Table-1 Analysis of standard alloys for the extraction of Pb(II) with 0.05%(w/v) Triphenylarsine oxide

Alloy	Composition %	Lead found mg	Standard deduction	Co-efficient of variation
Leaded Bronze (BCS 364)	Cu: 80.6; Sn:9.35 Pb: 9.25; Ni:0.28 Sb: 0.18; Zn: 0.13 As. 0.065; P. 0.056 Al: 0.002; Si: 0.003	9.23	0.005	0.05
Leaded Gunmetal (BCS 183/4)	Cu: 84.06; Pb:3.15 Sn: 7.27; Zn: 3.47 Ni: 0.13; S. 0.11	3.14	0.010	0.32

The method also permits extraction and determination of lead (40 μ g) from a synthetic mixture containing copper (30 μ g), Zinc (40 μ g), nickel (100 μ g) and tin (100 μ g), cobalt (40 μ g). The recovery of lead was 99.6%.

The proposed method is simple, accurate and permits rapid extraction, separation and determination of lead in alloys and synthetic samples.

References

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